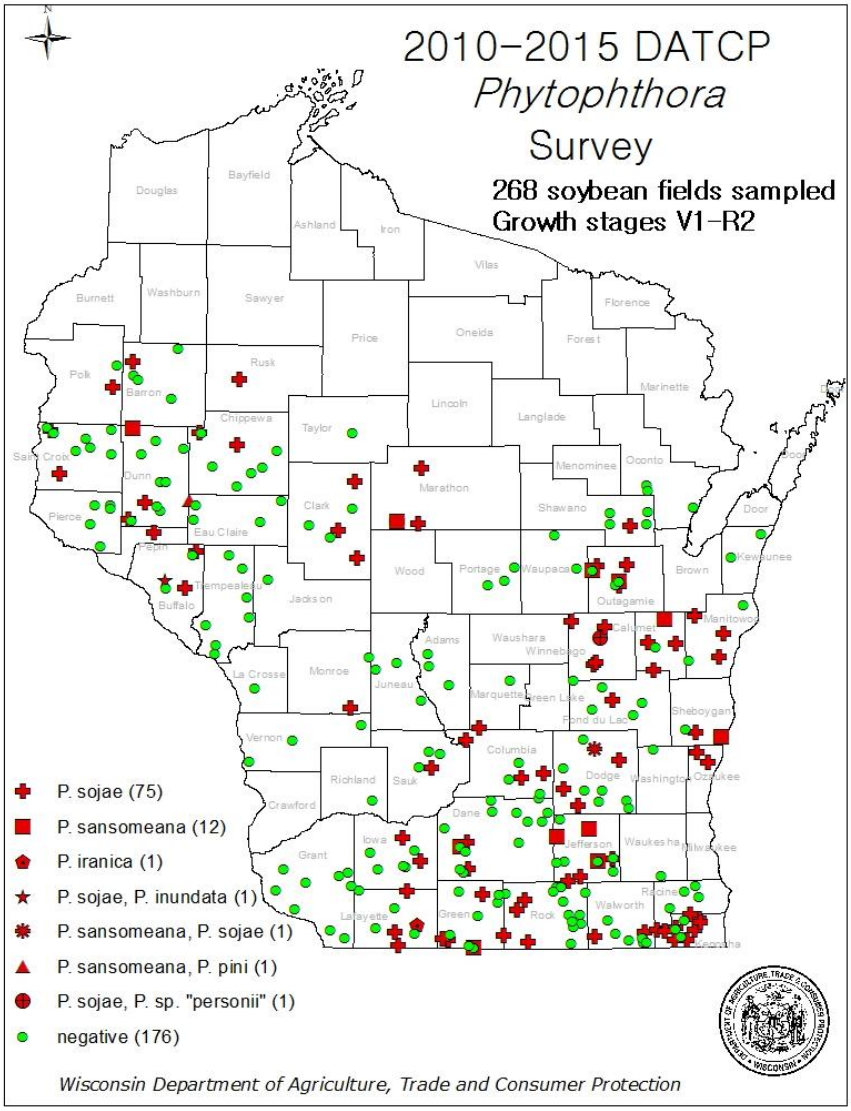
Wisconsin Department of Agriculture, Trade and Consumer Protection

Wisconsin Pest Survey Report

2008-2015 EARLY SEASON SOYBEAN ROOT ROT SURVEY

The annual early season survey of soybean fields documented a high prevalence of Phytophthora root rot disease in 2014 (49%) and 2015 (38%). This seedling disease was caused by ***Phytophthora sojae,*** based on DNA testing. Besides this well-known seedling root rot pathogen, this survey has been identifying the presence of Phytophthora species that are new to Wisconsin soybean production areas. Since 2012 five other Phytophthora species have been identified: ***P. sansomeana, P. pini, P. sp. "personii", P. inundata*** *and* ***P. iranica***.



The map shows the prevalence of all Phytophthora species detected on soybean seedling roots from 2010 to 2015.

P. sojae, a fungus-like organism, is the species that is well established in Wisconsin and known to cause damping-off and root rot disease in spring. Later in the season it causes characteristic brown lesions on the lower stem.

P. sojae is found in all major soybean growing areas of Wisconsin as shown on the map below that combines all survey data from 2008 to 2015.

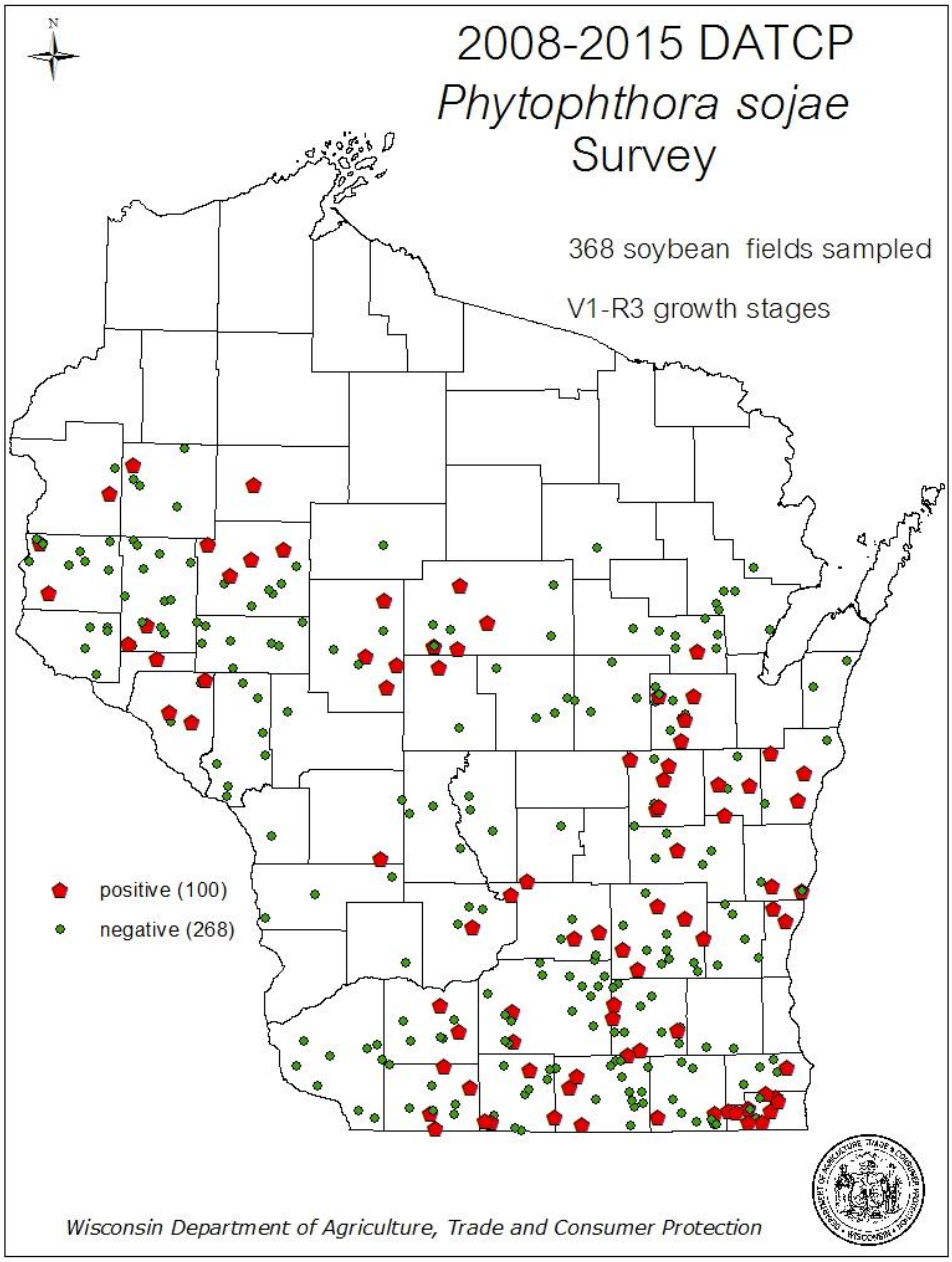


Table 1. below shows that more fields tested positive for ***P. sojae*** in 2008, 2010, 2014 and 2015. During these years, many growing areas experienced heavy rainfalls in spring causing prolonged saturation of soils and flooding, according to the Wisconsin Crop Progress Reports (6). One to two weeks of continuous moisture with temperatures

of 60-65 °F create ideal conditions for *P. sojae.* For information on soybean disease management please see UW-Extension website https://fyi.uwex.edu/fieldcroppathology/.

Since seedling root rot symptoms are virtually indistinguishable from those caused by Pythium, testing was expanded in 2011 to screen for this closely related pathogen as well. Table 1 shows the number of fields and percentage of fields infected with Phytophthora and Pythium. Pythium was present in the majority of fields surveyed. A break-down of all Pythium species identified can be found in a separate report on "Pythium Species Associated with Soybean Seedlings" on this website.

Table 1. Phytophthora (P.) and Pythium Survey Summary 2008-2015

Year	Survey Dates	Total Fields	*P. sojae*		*P. sansomeana*		*P. pini*	*P.* sp. *personii*	*P. inundata*	*P. iranica*	*Pythium spp.*
2008	6-23 to 7-17	50	12	24%	NA	NA	NA	NA	NA	NA	NA
2009	7-9 to 7-17	50	9	18%	NA	NA	NA	NA	NA	NA	NA
2010	6-16 to 7-9	45	17	38%	0	0	0	0	0	0	NA
2011	6-14 to 7-14	15	2	13%	0	0	0	0	0	0	13 (87%
2012	5-29 to 7-2	49	8	16%	3	6%	0	0	0	0	49 (100%)
2013	6-17 to 7-18	52	7	13%	5	10%	0	0	0	0	46 (94%)
2014	6-6 to 7-16	53*	26	49%	4	8%	1 (2%)	1 (2%)	0	0	52 (98%)
2015	6-2 to 6-30	50	19	38%	2	4%	0	0	1 (2%)	1(2%)	50 (100%)

* An additional 4 corn fields were tested. All tested negative.

Detection Methods. Plant collections were made during vegetative and early reproductive growth stages; survey dates varied each year depending upon spring growing conditions. Fields were chosen at random but sampling within a field was biased toward areas prone for root rot such as low lying areas, field access areas and headlands. Twenty seedlings were carefully dug up and combined into one sample from each field. Soybean roots were washed thoroughly before root tissue was tested for the presence of Phytophthora and Pythium. Starting in 2010 we expanded pathogen testing from *P. sojae* species-specific testing to include other species of Phytophthora. Gene based methods, such as PCR (polymerase chain reaction) combined with gene sequence analysis, allowed us to identify these pathogens quickly and reliably to species level (1, 3, 5)

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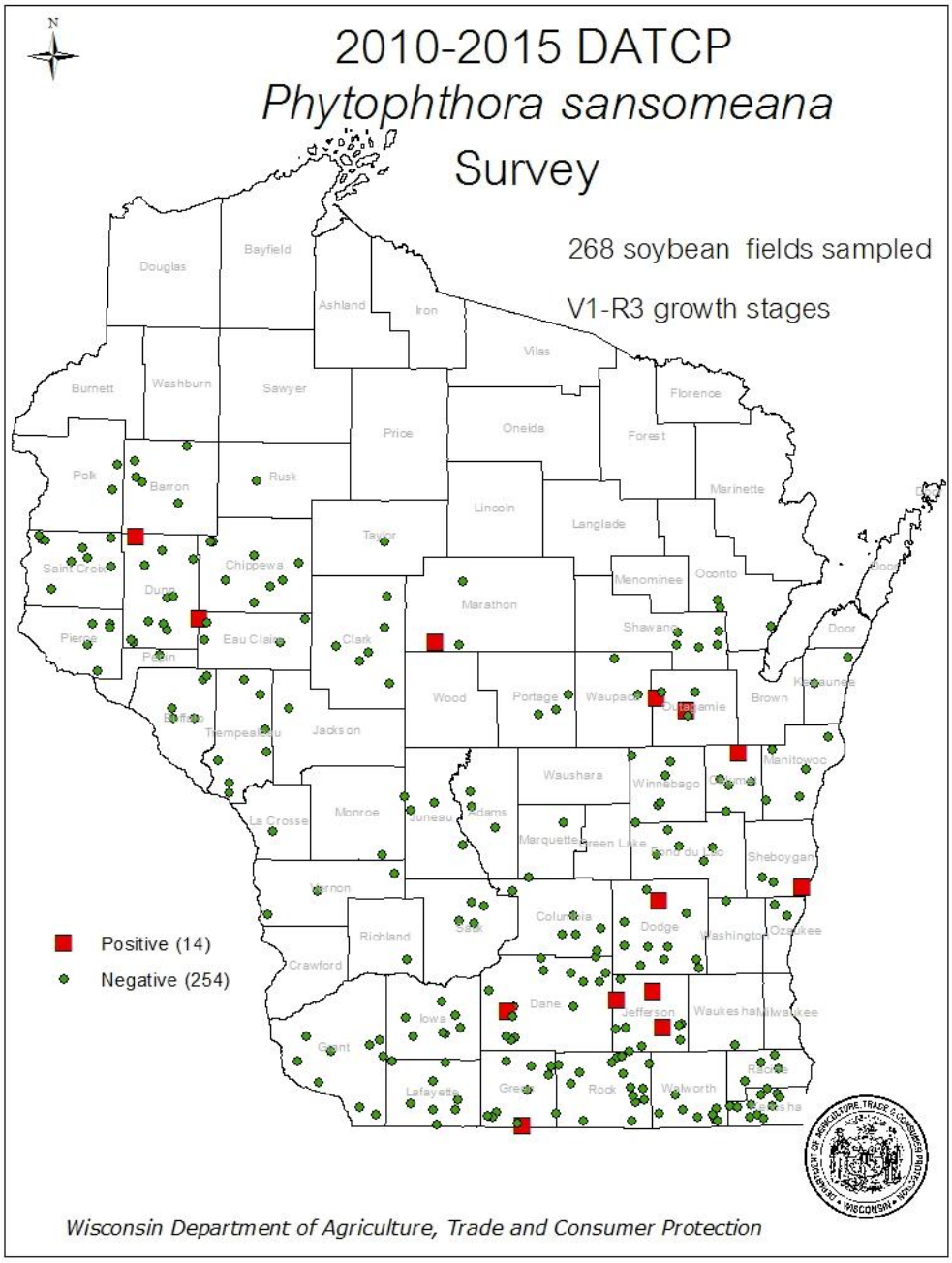
Phytophthora sansomeana was detected on soybeans for the first time in 2012 in Wisconsin. Symptoms observed on seedling roots infected with *P. sansomeana* consisted of lesions on tap and lateral roots, and decaying fine roots. The brown stem lesions characteristic for *P. sojae* are not associated with *P. sansomeana*.

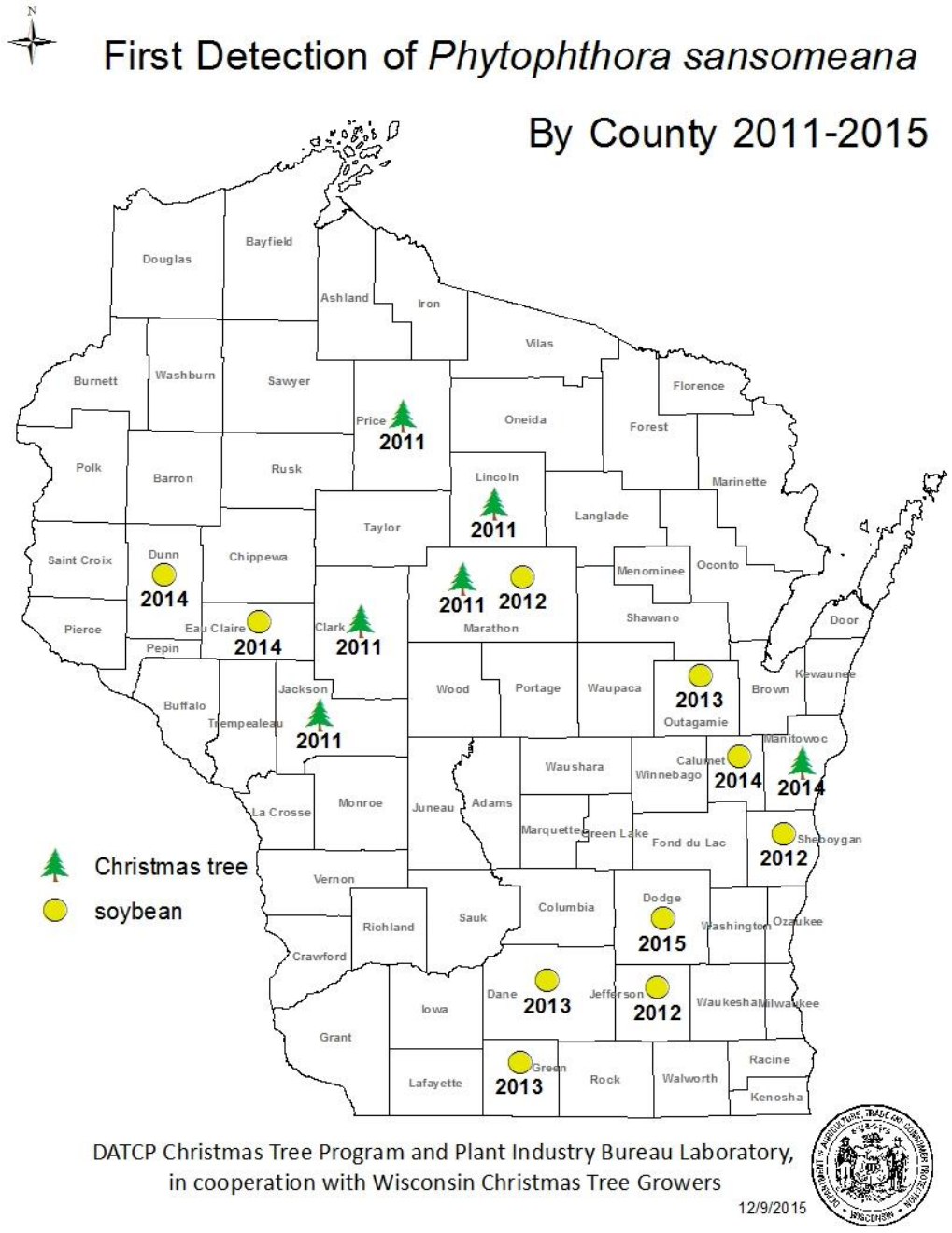
The 2015 survey found *P. sansomeana* in 2 soybean fields in Jefferson and Dodge counties, adding Dodge County to the list of 10 Wisconsin counties were *P. sansomeana* has been documented in Wisconsin (Calumet, Dane, Dodge, Dunn, Eau Claire, Green, Jefferson, Marathon, Outagamie and Sheboygan). The map below shows all sites surveyed from 2010 to 2015.



In 2013 this survey detected *P. sansomeana* in corn roots but there was no disease associated with the infected corn. Unlike *P. sojae* which is specific to soybeans, *P. sansomeana* can infect multiple hosts. The corn field in which it was found had a history of *P. sansomeana*-infected soybeans. In a corn-soybean crop rotation this pathogen could build-up over time in the soil. We believe 2013 was the first detection of *P. sansomeana* in corn in Wisconsin.

Researchers have reported *P. sansomeana* on corn in Ohio, soybeans in Indiana, Douglas fir seedlings in Oregon, and weeds in New York (2). *P. sansomeana* was also reported to have caused significant losses on soybean in China (4). Culture isolates from the Wisconsin soybean survey are being tested on both corn and soybeans at UW-Madison to evaluate pathogenicity under Wisconsin growing conditions.

In addition to affecting field crops, we have detected *P. sansomeana* detected in Christmas tree plantations on Fraser and balsam fir in six Wisconsin counties (Clark, Jackson, Lincoln, Manitowoc, Marathon and Price). This brings the total number of Wisconsin counties where *P. sansomeana* has been identified since 2011 to 15, see the map below.



Other Phytophthora detected in soybean roots are: ***P. pini*** and ***P. sp. "personii"*** in 2014 and ***P. inundata*** and ***P. iranica*** in 2015. To the best of our knowledge, the last three

species have never been detected in Wisconsin before. All four species are first detections in Wisconsin soybeans.

P. pini was isolated from a soybean sample from Eau Claire Co. that was also infected with *P. sansomeana*. *P. sp. "personii"* was cultured from Winnebago Co. soybean roots that also tested positive for *P. sojae*. *P. inundata* was detected in Buffalo Co., in a field that were *P. sojae* was present as well. *P. iranica* was found in Lafayette Co.

P. pini (formerly included in *P. citricola*) is generally considered to be a pathogen of shrubs and trees. The organism survives well in surface waters and could inadvertently be introduced by flooding or irrigating with pond or river water. *P. pini* has been reported in Wisconsin under the name *P. citricola*.

***P. sp.* "*personii*"** is new to science and has yet to be formally described. It was originally found in rivers and wetland soils in Australia, where it affects horticultural crops.

P. inundata was first described in 2003 in wet or flooded soils in Europe and South America. It is associated with root and collar rots of hardwood trees and shrubs (horse chestnut, olive, willow and grape). The known hosts of **P. iranica** found in Iran in 1971 are: eggplant, potato, tomato and sugar beet.

None of these species have previously been associated with soybeans and their significance for soybean production remains to be determined.

References:

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2. Hansen E.M., Wilcox W.F., Reeser P. W. 2009. Phytophthora rosacearum and P. sansomeana, new species segregated from the Phytophthora megasperma "complex". Mycologia 101:129-135.
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